

# Soil and Land Regeneration Through Agriculture

Sundaora Alford-Purvis  
Canadian Society

For

Organic Urban Land Care



# Soil and Ecosystem Loss

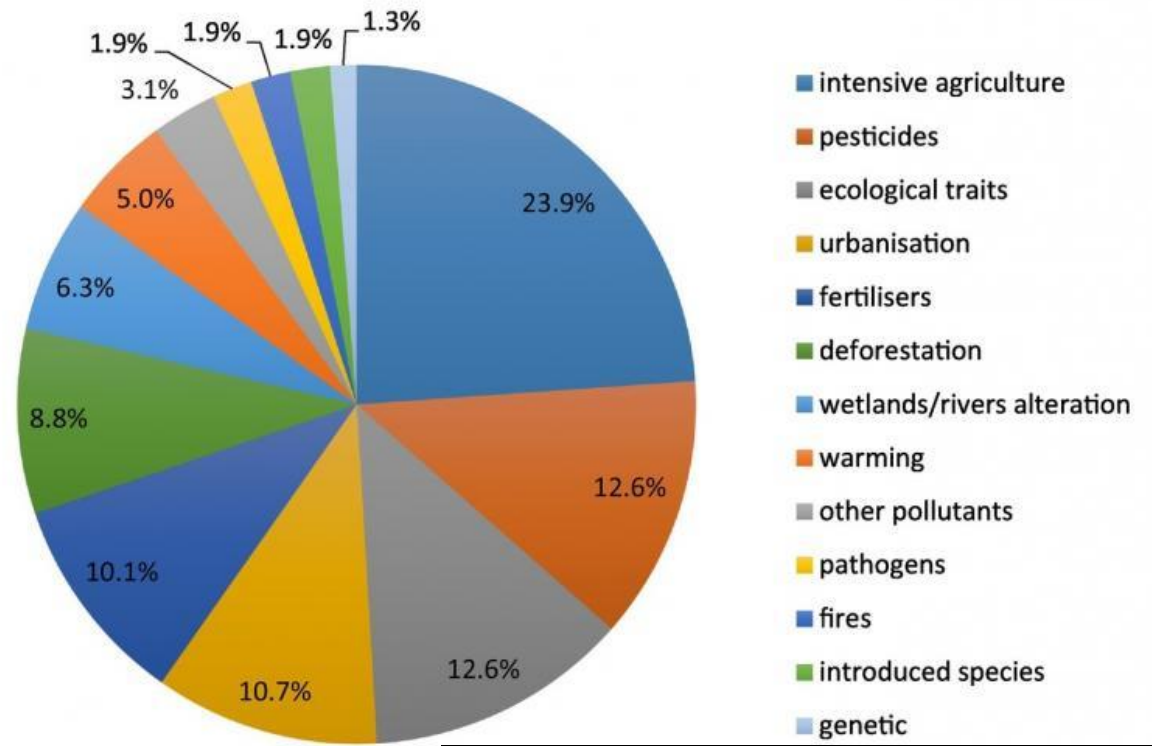
- In my lifetime:
  - The global biomass of wild mammals has fallen by 82%.
  - Natural ecosystems declined by 47% on average, relative to their earliest estimated states
- Soil degradation and biodiversity loss are severe and accelerating
- Farm profits are falling
- Risks from severe weather events are increasing

## Third of Earth's soil is acutely degraded due to agriculture

Fertile soil is being lost at rate of 24bn tonnes a year through intensive farming as demand for food increases, says UN-backed study



# Global Insect Populations Plummeting



Plummeting insect numbers 'threaten collapse of nature'



ENVIRONMENT



## Insect 'apocalypse' in U.S. driven by 50x increase in toxic pesticides

Bees, butterflies, and other insects are under attack by the very plants they feed on as U.S. agriculture continues to use chemicals known to kill.

# Changing Weather is Leading to Declining Harvest

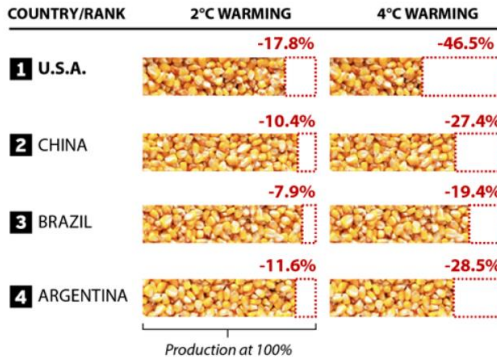
## Climate Change Raises Risks to Corn

New research projects that rising global temperatures will reduce yields in the world's largest corn-producing regions and could lead to food shortages.

inside climate news

### MAIZE PRODUCTION PROJECTIONS

Projections under different warming scenarios, top producers, mean figures



SOURCE: Tigchelaar et al., 2018

PAUL HORN / InsideClimate News



A farmer checks on his wheat crop after snowy weather near Cremona, Alberta, north of Calgary on Sept. 30. Early snow and frost is threatening the harvests across western Canada (Jeff McIntosh/The Canadian Press)

## Early snow stalls western Canadian harvest

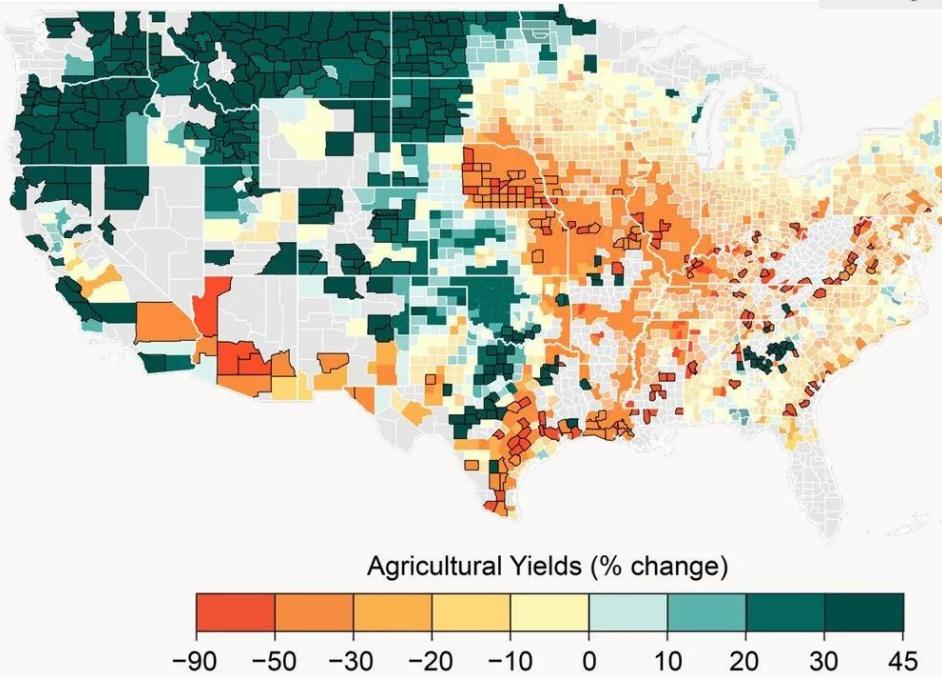
## Ontario farmers' planting season significantly delayed thanks to soggy spring weather



BY JAKE JEFFREY · 980 CFPL

Posted June 7, 2019 2:32 pm

Updated June 7, 2019 3:51 pm

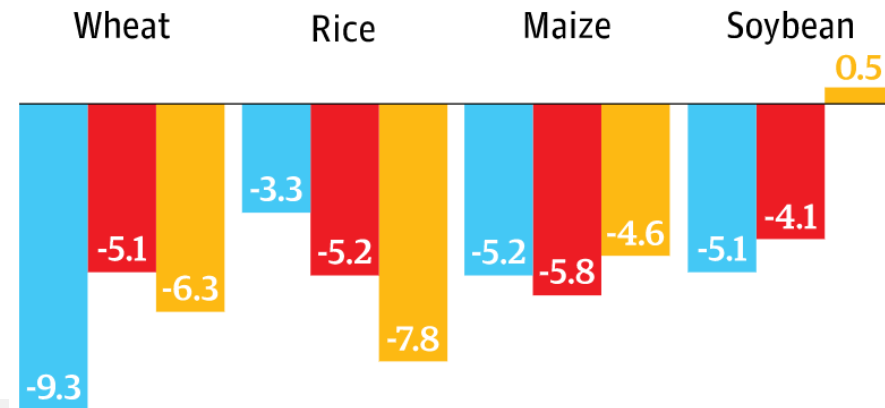


## High CO2 cuts crop nutrients

Increased  
Atmospheric  
Carbon is Causing  
Nutrient Density  
to Decline

Percentage under CO2 levels expected  
in 2050,

■ Zinc ■ Iron ■ Protein



How climate change impacts the concentration of key nutrients in crops




Jul 17, 2018

by

Matthew R. Smith (Harvard T. H. Chan School of Public Health), Samuel S. Myers (Harvard T. H. Chan School of Public Health) and Philip Thornton (CCAFS)

Flagships

 Priorities and Policies for CSA

# Time for some Good News

- There are some really interesting, inspiring, grass-roots things happening in food and agriculture and they don't get much attention in media so we rarely get to hear about them.
- Which is a bit strange, because they present real, viable solutions to some of the most daunting challenges we are dealing with at the moment, including food insecurity, ecosystem failure, biodiversity loss, urban flooding, and global heating.

# FOOD REGENERATIVE AGRICULTURE

RANK AND RESULTS BY 2050

23.15 GIGATONS  
REDUCED CO<sub>2</sub>

\$57.22 BILLION  
NET IMPLEMENTATION COST

\$1.93 TRILLION  
NET OPERATIONAL SAVINGS

## ELECTRICITY GENERATION

Biomass  
Cogeneration  
Concentrated Solar  
Energy Storage (Distributed)  
Energy Storage (Utilities)  
Geothermal  
Grid Flexibility  
In-Stream Hydro  
Methane Digesters (Large)  
Methane Digesters (Small)  
Micro Wind  
Microgrids  
Nuclear  
Rooftop Solar  
Solar Farms  
Solar Water  
Waste-to-Energy  
Wave and Tidal  
Wind Turbines (Offshore)  
Wind Turbines (Onshore)

## FOOD

Biochar  
Clean Cookstoves  
Composting  
Conservation Agriculture  
Farmland Irrigation  
Farmland Restoration  
Improved Rice Cultivation  
Managed Grazing  
Multistrata Agroforestry  
Nutrient Management  
Plant-Rich Diet  
Reduced Food Waste  
Regenerative Agriculture  
Silvopasture  
System of Rice  
Intensification  
Tree Intercropping  
Tropical Staple Trees

## WOMEN AND GIRLS

Educating Girls  
Family Planning  
Women Smallholders

Heat Pumps  
Insulation  
Landfill Methane  
LED Lighting (Commercial)  
LED Lighting (Household)  
Net Zero Buildings  
Retrofitting  
Smart Glass  
Smart Thermostats  
Walkable Cities  
Water Distribution

## LAND USE

Afforestation  
Bamboo

High-speed Rail  
Mass Transit  
Ridesharing  
Ships  
Telepresence  
Trains  
Trucks

## MATERIALS

Alternative Cement  
Bioplastic  
Household Recycling  
Industrial Recycling  
Recycled Paper  
Refrigerant Management

Direct Air Capture  
Enhanced Weathering of  
Minerals  
Hydrogen-Boron Fusion  
Hyperloop  
Industrial Hemp  
Intensive Silvopasture  
Living Buildings  
Marine Permaculture  
Microbial Farming  
Ocean Farming  
Pasture Cropping  
Perennial Crops  
Repopulating the Mammoth  
Steppe

31.19 GIGATONS  
REDUCED CO<sub>2</sub>

\$41.59 BILLION  
NET IMPLEMENTATION COST

\$699.37 BILLION  
NET OPERATIONAL SAVINGS

# FOOD SILVOPASTURE

# Farmer Led Solutions

## Small Farms don't Produce Most of the Worlds' Food – But they Could Produce All

By [Gunnar Rundgren](#), originally published by [Garden Earth](#)

🕒 August 21, 2019



## HALF THE CORN, MORE PROFIT?

July 25, 2019

Written by [Ananda Fitzsimmons](#)

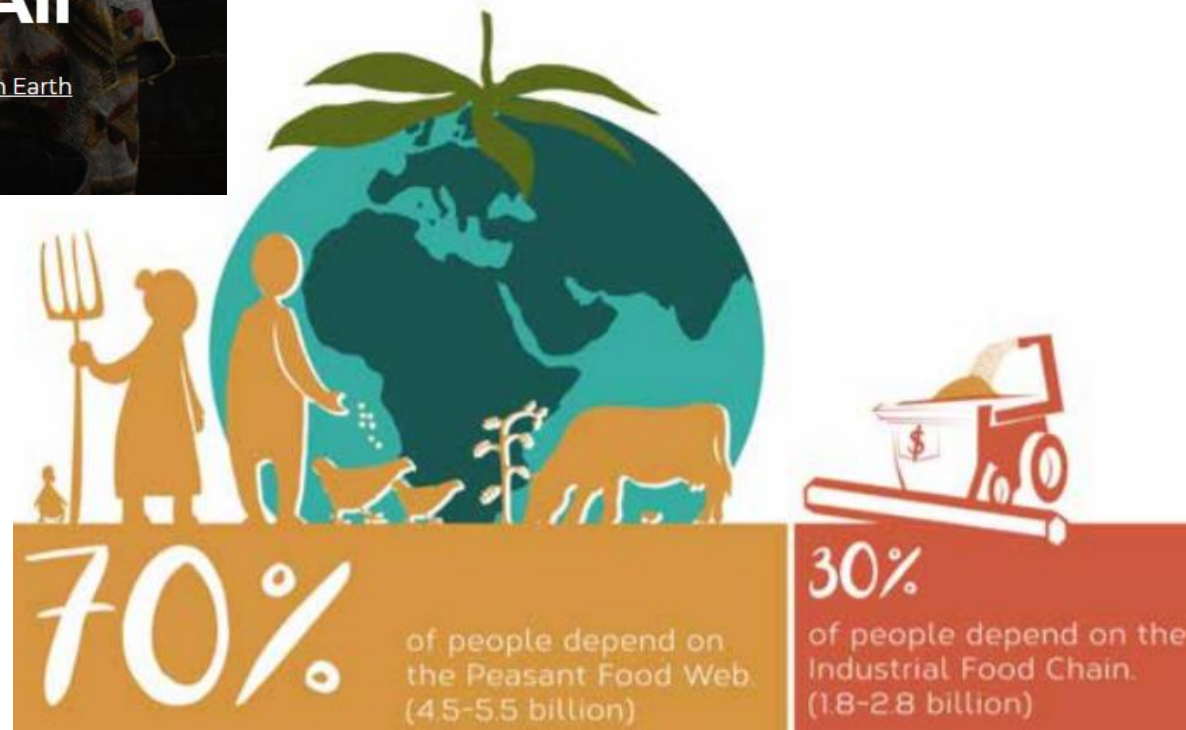
Cover crops Organic



Canadian Organic Growers  
Cultivons Biologique Canada



ECOLOGICAL FARMERS  
ASSOCIATION OF ONTARIO





# Solving Several Problems

The same practices that restore soil carbon:

- Reduce or reverse other ecological harms
- Increase farm profits
- Decrease sensitivity to extreme weather events, including droughts and flooding.
- Increase biodiversity and support non-agricultural species (birds, pollinators, invertebrates, etc.)

# How it Works:

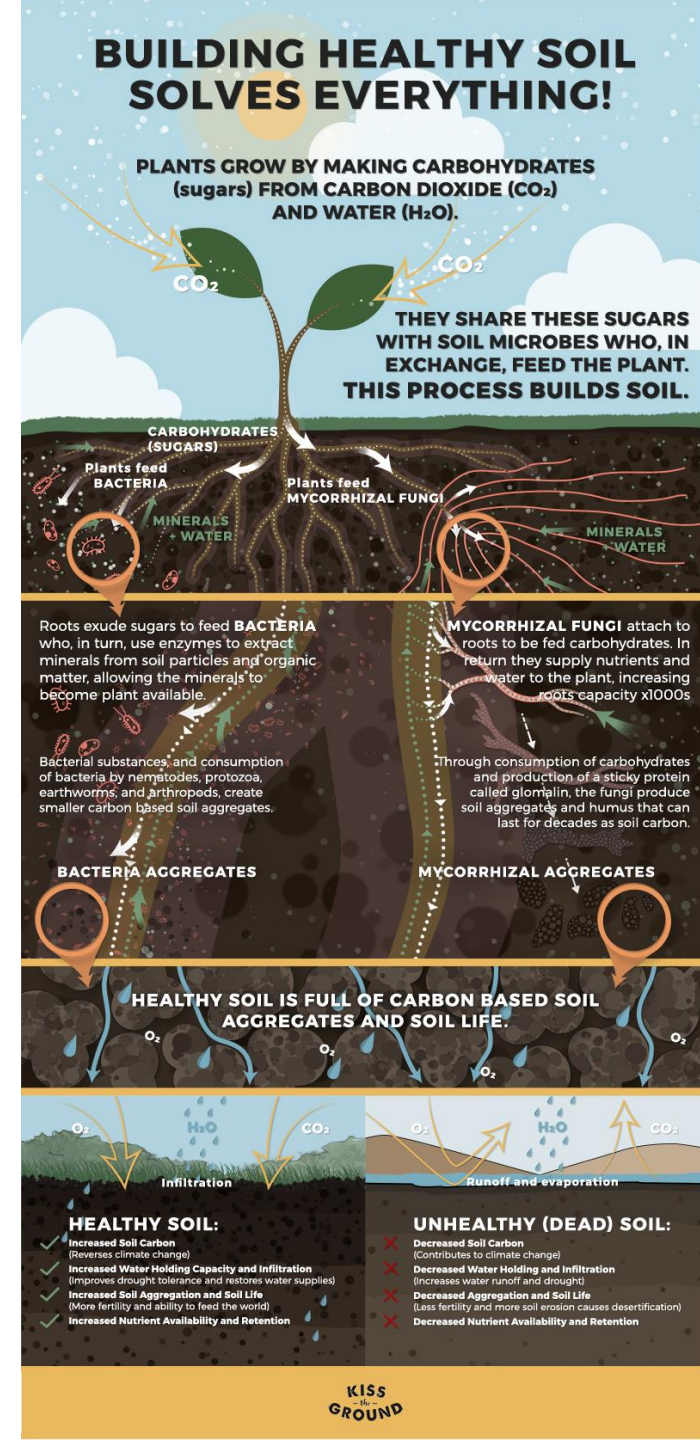
## 60 Seconds on the Soil Carbon Cycle:

- As plants grow, they capture atmospheric carbon dioxide, break the oxygen molecules off of the carbon, releasing them, and hold onto the carbon, either as liquid sugar (carbohydrate) or as part of their structural tissue. They also release a large percentage as root exudate into the soil to feed the biology there. Plants rely on soil biology for everything from nutrient and water transportation, through nitrogen fixation to defence against pests and diseases.
- A portion of the carbon is metabolized, eventually making its way back into the atmosphere, and the remainder is sequestered in the soil in a stable form.

# When Carbon is in the Soil it:

- Improves soil resistance to erosion
- Helps soil to hold water, without becoming waterlogged. (1% carbon increase in the top foot of soil = 1" more water that can be held in the soil)
- Helps soil hold onto soluble nutrients
- Provides habitat for biology that supports healthy plant growth

**All of which lead to increased ecosystem resilience and improved crop reliability and productivity.**



# Soil Carbon = Climate Solution

- Global soils contain 2 to 3 times more carbon than the atmosphere and a huge amount of the atmospheric carbon cycles through plants and soils each year. If agricultural soil carbon level increased by 0.4%, or 4 ‰ per year, in the top 30-40 cm of soil, annual sequestration would match global carbon emissions, as of 2015.

<https://www.4p1000.org/>

- **The excess carbon that we've dumped into the atmosphere can be sequestered in agricultural soils by plants and soil biology.**

# How are farmers working with plants to build soil carbon?

- Minimizing soil disturbance, especially avoiding inverting the soil profile. (No Till)
- Keeping soil covered with plant material throughout the year. (Cover Crops)
- Mimicking the grazing cycles that plants evolved with by rotational or mob grazing. (This is what makes some beef carbon negative)
- Minimizing or eliminating applications of concentrated materials that disturb soil biological function or accelerate the oxidization of humus

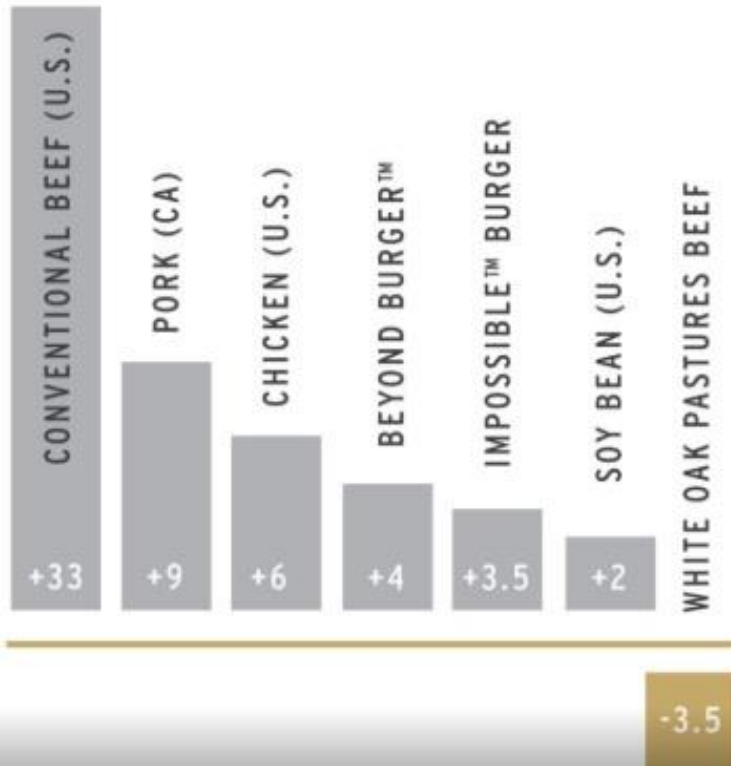
# How are farmers working with plants to build soil carbon?

- Planting perennial species, including trees, within agricultural systems. (Sylvaculture/Sylvapasture)
- Growing a diverse blend of plant species
- Cycling all organic waste back into the soil
- Supporting / reintroducing soil biology through compost applications (<https://www.marincarbonproject.org/>)
- Directly integrating animal agriculture into perennial and annual crop systems (<https://www.savory.global/>)
- Trying, monitoring, adapting, adjusting, repeating

# NET TOTAL EMISSIONS

## WHITE OAK PASTURES VS OTHER PROTEINS

(PER POUND OF PRODUCT)

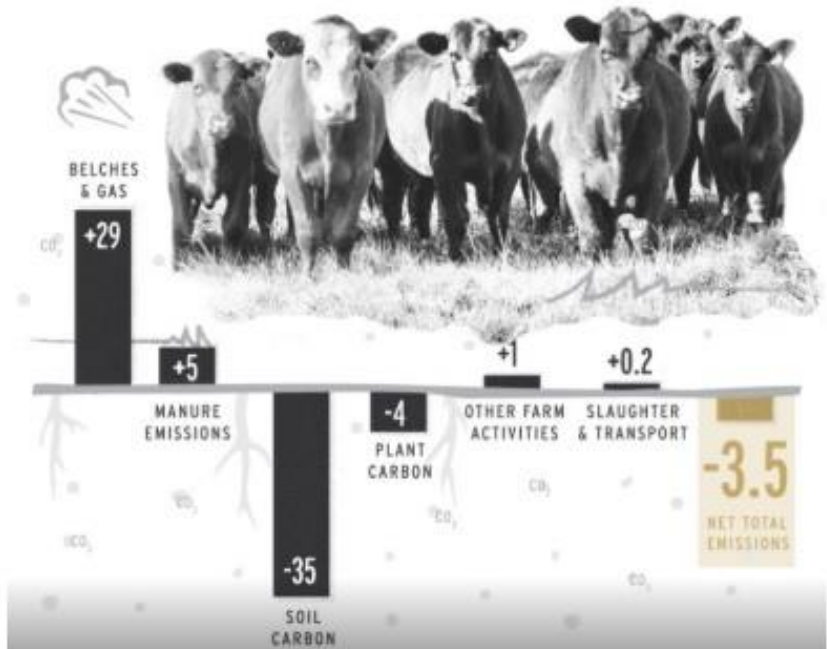


Source: Carbon Footprint of Protein, 2013. [www.vegetarianresources.com](http://www.vegetarianresources.com)

# WHITE OAK PASTURES BEEF SEQUESTERS MORE CARBON THAN IT EMITS

Emissions breakdown for every pound of White Oak Pasture's beef produced:

(POUNDS OF CO<sub>2</sub> EQUIVALENT)



Source: Carbon Footprint of Protein, 2013. [www.vegetarianresources.com](http://www.vegetarianresources.com)

Graphics courtesy of EPIC Provisions

# Not Singular. Not New.

- No one solution can be applied to all systems, regions, ecosystems or food systems. Regenerative agriculture is less a set of activities than a set of outcomes.
- This isn't entirely, or even mostly, new, although technology is helping us understand, and hopefully better support, soil life.
- Some of the change that has to happen is in how we think about ecosystems, moving from an extractive relationship to a reciprocal one.



# So, what can you do?

- Look for local foods produced by farmers using regenerative practices.
- Purchase local, in-season foods.
  - Reduces transportation, especially refrigerated transport
  - Increases local food security
  - Grown to national safety and human rights standards
  - Reduces waste at the production and storage stages
- If you have a garden, or any land that you work with, you can implement the same practices that are regenerating agricultural soils since most of them are scalable. (Maybe not the grazing...)

# So, what can you do?

- Try to use what you buy (research shows 30-50% Food waste in Canada)
- Compost any organic matter that comes out of your garden or kitchen (vermicompost, bokashi bins etc.).
- Spread the word – most people don't know about living soils or that healthy soils can be a large part of the transition and mitigation that we need to deal with the effects of climate breakdown
- Contact your elected representatives. (Why are wasting our organic matter? Why aren't we investing in living green infrastructure? Why aren't we valuing ecosystem services? Why aren't we engaging farmers in carbon sequestration and flood mitigation?)
- [Sign the 'Hold the line on urban sprawl' petition](#)

# Learn about your ecosystem from the people who guided its creation

- Indigenous knowledge, leadership and practices, with their millennia of ecosystem experience and understanding, will be critical to finding long term solutions.

## **INDIGENOUS COMMUNITIES ARE BETTER AT PRESERVING BIODIVERSITY, RESEARCH SHOWS**

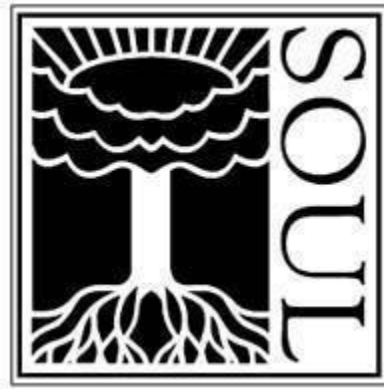
A new study adds to research showing concrete links between Indigenous rights to land and sustainable conservation.

MAXINE SPEIER · AUG 1, 2019



**IPCC Agrees with Indigenous Peoples and Local Communities on Climate Change**

Finally, the world's top scientists recognize what we have always known.



A copy of this presentation, with active links to the resources referenced, can be downloaded from the SOUL website, in the resources section.

[www.organiclandcare.ca/presentations](http://www.organiclandcare.ca/presentations)